Remarks/Arguments

Applicant has carefully considered the rejections in the previous office action and submits the foregoing amendments and the following response. The amendments add no new matter, and are believed to place the application in condition for allowance.

Rejection of claims 1-7 and 9-21

The examiner maintains the rejection of claims 1-7 and 9-21 as obvious over Suppes in view of Chen, Wittenbrink, Berlowitz, and Tanasawa. The examiner also cites GB 2215032A (Shin).

Response

Claims 1-21 have been canceled. New independent claim 22 reads as follows:

> A process for reducing emissions operating a yellow flame burner, the process comprising:
>
> feeding to **a yellow flame burner adapted to burn petroleum derived gas oil** one or more liquid Fischer-Tropsch product comprising iso-paraffins and normal paraffins, the **one or more liquid Fischer-Tropsch product having a density of between 0.65 and 0.8 g/cm^3 at 15 °C**;
>
> burning the one or more liquid Fischer-Tropsch product using the yellow flame burner under conditions comprising a value of lambda of from about 1 to about 2 producing improved flue gas comprising less carbon monoxide and less NO_x than flue gas produced burning only petroleum derived gas oil; and,
>
> performing one or more procedure selected from the group consisting of heating water by indirect heat exchange with the improved flue gas in one or more boiler and heating space directly with the improved flue gas.

Claim 22 (emphasis added). New independent claim 29 is the same, but specifies feeding to the yellow flame burner "a **blend** comprising one or more liquid Fischer-Tropsch product." New independent claim 37 is the same as claim 22, but

additionally specifies that the burning produces a flame, and "detecting the flame using a blue flame detector."

New claims 39 specifies:

feeding to a yellow flame burner adapted to burn petroleum derived gas oil one or more liquid Fischer-Tropsch product comprising iso-paraffins and normal paraffins and having a density of between 0.65 and 0.8 g/cm^3 at 15 °C, the one or more liquid Fischer-Tropsch product being selected from the group consisting of Fischer-Tropsch kerosene and Fischer Tropsch gas oil;

burning the one or more liquid Fischer-Tropsch product using the yellow flame burner under conditions comprising a value of lambda of from about 1.05 to about 1.2 producing improved flue gas comprising 100 mg/kWh or less carbon monoxide and 150 mg/kWh or less NO_x at said value of lambda; and,

See Examples 1 and 2 and Figures 2 and 3. Claim 42 is similar, but specifies feeding to the yellow flame burner a "blend comprising the one or more Fischer Tropsch product." *Id.*

<u>The lower density of F-T fuels</u>

All of the claims specify that the one or more liquid Fischer Tropsch product has "a density of between 0.65 and 0.8 g/cm^3 at 15 °C." As explained in the specification, "[a]s a result of the low contents of aromatics and naphthenic[] compounds the density of the Fischer-Tropsch product will be lower than the conventional mineral derived fuels. The density will be between 0.65 and 0.8 g/cm^3 at 15 °C." Specification, p. 5, ll. 16-20. See also Table 1, where the tested fuels had the following densities:

Fuel	**Density (kg/m^3 at 15 °C)**
Fischer Tropsch Kerosene (Oil A)	734.8
Fischer Tropsch gas oil (Oil B)	785.2
Ultra low sulphur gas oil (Oil D)	846.3
Industrial gas oil (Oil C)	854.3

The density of the petroleum derived gas oils in Table 1 was at least 60 kg/m^3 greater than the Fischer-Tropsch products at 15 °C.

The examiner cannot point to any teaching or suggestion in any cited reference that the claimed liquid Fischer-Tropsch products "having a density between 0.65 and 0.8 g/cm^3 at 15 °C" would be effective fuels for operating a yellow flame burner. The examiner cannot point to any teaching or suggestion in the cited references that the claimed lower density liquid Fischer-Tropsch products (or blends) would effectively vaporize and/or atomize to form an effective spray for combustion by the yellow flame burner. The examiner cannot point to any teaching or suggestion that the claimed low density liquid Fischer Tropsch products would ignite and burn under the conditions produced by a yellow flame burner. The examiner cannot pointed to a teaching or suggestion regarding whether the claimed low density liquid Fischer-Tropsch products would produce a stable flame over time. Nor can the examiner point to a teaching or suggestion whether burning these low density liquid Fischer-Tropsch products would form deposits that could impact a number of things, including emissions.

The examiner certainly cannot point to a teaching or suggestion that the claimed lower density liquid Fischer Tropsch products could be used in a yellow flame burner for direct heating of large spaces. As explained in the specification:

> Normally gaseous fuels for example natural gas, LPG and the like, are used for this application because the associated flue gasses can be safely supplied to said space. A disadvantage of the use of gaseous fuels is however that handling of the pressurized gas containers and combustion equipment requires professional skills in order to operate such an apparatus safely. By using a Fischer-Tropsch derived liquid fuel a comparable flue gas is obtained in the yellow flame burner as when a gaseous fuel is used. Thus a method is provided wherein a liquid fuel can be applied for direct heating of spaces. The application of the liquid Fischer-Tropsch derived fuel makes the use of the apparatus for direct heating much more simple and safe.

Specification, p. 4, ll. 9-22. The examiner simply cannot point to a teaching or suggestion in the cited references to feed one or more liquid Fischer-Tropsch product "having a density between 0.65 and 0.8 g/cm^3 at 15 °C" to a yellow flame burner for direct heating of large spaces.

The examiner cites several references related to diesel fuels comprising Fischer-Tropsch products for **operating automotive engines**. However, the fuel in

an automotive engine is ignited and burned in an entirely different fashion than fuel fed to a yellow flame burner.

Burning of fuel in a yellow flame burner is described in the specification as follows:

> Conventional designs of oil burner assemblies for home heating fuel oils employ a traditional fuel/air mixing process in which the evaporation and combustion of the fuel oil take place simultaneously. In one form of oil burner assembly for home heating fuel oils the fuel oil is sprayed as a hollow cone and air is weakly swirled along a path which is parallel to the axis of a burner blast tube and which passes into the hollow cone so that the trajectories of the fuel oil droplets cross the air flow streamlines. This leads to a rapid evaporation giving fuel oil rich regions, which in turn ignite under local sub-stoichiometric conditions producing soot, and results in air pollution as well as a waste of a fossil fuel.

Specification, p. 1, l. 3 –16. As further explained on p. 3, ll. 3-10 (emphasis added):

> Figure 1 shows a yellow flame burner 1 having pumping means 2 to supply a liquid fuel and a van 3 to supply an oxygen containing gas. The oxygen containing gas is usually air. **The fuel is dispersed in a nozzle 4 and mixed with the air to form a combustible mixture, which is fed to a combustion space 5 via a conical shaped nozzle 6. Figure 1 also shows means 7 to ignite the mixture.**

Even if diesel fuel is burned for purposes of domestic heating in some markets, GB 2215032 A (Shin) establishes that diesel fuels have high ignition points that require preheating and/or special hardware in order for a "gasifying stove" to completely combust the diesel fuel:

> It is found that most fuels for gasifying stoves are kerosene and Diesel fuel oil which are of high igniting point. Hence, in order to cause the fuel to be burned easily, it is commonly suggested to set a **preheating procedure** so that the fuel will be heated prior to its gasification thereby helping to combust [] the fuel. **However, the temperature increase[] in such preheating procedure is often insufficient to cause a complete combustion, thus wasting fuel, lowering the efficiency as well as polluting the environment.**

Shin, p. 1, ll. 4-17 (emphasis added).

The claims specify feeding the one or more lower density liquid Fischer Tropsch product or blend to a yellow flame burner "**adapted to burn petroleum**

derived gas oil." Shin establishes that, because of their high igniting points, diesel fuels require preheating or special hardware in order to be completely combusted by "gasifying stoves." Using the examiner's own reasoning, Shin weighs against a finding that the claimed method would have been obvious.

The examiner cannot point to a teaching or suggestion to feed diesel fuel to a yellow flame burner **adapted to burn petroleum derived gas oil.** The examiner clearly cannot point to a teaching or suggestion to feed diesel fuel **comprising the claimed one or more low density liquid Fischer Tropsch product** to a yellow flame burner to "perform[] one or more procedure selected from the group consisting of heating water by indirect heat exchange with the improved flue gas in one or more boiler and heating space directly with the improved flue gas." The examiner certainly cannot establish that "burning the one or more liquid Fischer-Tropsch product using the yellow flame burner under conditions comprising a value of lambda of from about 1.05 to about 1.2 [would] produc[e] improved flue gas comprising 100 mg/kWh or less carbon monoxide and 150 mg/kWh or less NO_x." Claims 39 and 42.

As the U.S. Supreme Court recently observed, "inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. ____, 127 S.Ct. 1727, 82 U.S.P.Q.2d 1385, 1396 (U.S. 2007). For this reason, "**[a] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, *independently*, known in the prior art.**" *Id.* (emphasis added). The Federal Circuit recently reaffirmed that "**a flexible TSM [teaching-suggestion-motivation] test remains the primary guarantor against a non-statutory hindsight analysis.**" *Id.* at 11, citing *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

The examiner cannot point to a teaching or suggestion in the cited references of every element of the new claims, and cannot meet the flexible TSM test with respect to any of the new claims.

Applicant requests consideration and allowance of all of the pending claims.

-Near stoichiometry

New independent claims 39 and 42 specify using the yellow flame burner under "conditions comprising a value of lambda of from about 1.05 to about 1.2." New independent claims 39 and 42 also specify "producing improved flue gas comprising 100 mg/kWh or less carbon monoxide and 150 mg/kWh or less NO_x"

The examiner cannot point to a teaching or suggestion in the cited references of every limitation of new independent claims 39 or 42.

As explained in the specification:

> Applicants found that by using a Fischer-Tropsch derived fuel a very low lambda of between 1.05 and 1.2 could be applied without large emissions of carbon monoxide as would be the case when Industrial Gas Oil would be used.

Specification, p. 3, ll. 19-22.

Operation of a yellow flame burner is more efficient at a value of lambda that is at or near stoichiometric. Basically, combustion consumes oxygen and produces heat and exhaust gas comprising carbon dioxide and other components, depending upon the fuel. Unfortunately, at least some conventional fuel oils produce excessive carbon monoxide emissions at low lambdas. See the ultra low sulphur gas oil (Oil D) in Figure 3 (Example 1).

Applicants unexpectedly found that the amount of carbon monoxide in improved flue gas produced burning several Fischer Tropsch products at a lambda of about 1.1 or lower using a yellow flame burner was consistently about 100 mg/kWh or less. See Figure 3 (Example 1).

Specifically, burning both a Fischer-Tropsch derived kerosene (Oil A) and a Fischer-Tropsch gas oil (Oil B) at a lambda of about 1.1 produced improved flue gas with only about 80 mg/kWh of carbon monoxide. Burning a standard industrial gas oil (Oil C) at a lambda of about 1.1 using the yellow flame burner produced flue gas with a similarly low carbon dioxide content. However, burning an ultra low sulphur gas oil (Oil D) at a lambda of about 1.1 using the yellow flame burner produced flue gas with a carbon monoxide content of over 140 mg/kWh carbon monoxide. Although the carbon monoxide emissions of the standard gas oil (Oil C)

were low at a lambda of about 1.1, the amount of NO_x in flue gas produced using the standard gas oil (Oil C) was almost 200 mg/kWh, compared to less than 150 mg/kWh for all of the other fuels. Figure 2, Example 1.

The process of independent claims 39 and 42 provides near stoichiometric operation of a yellow flame burner at a value of lambda of from about 1.05 to about 1.2 that consistently produces improved flue gas comprising 100 mg/kWh or less carbon monoxide and 150 mg/kWh or less NO_x.

The examiner cannot point to a teaching or suggestion in the cited references of every element of the new claims 39 and 42, and cannot meet the flexible TSM test with respect to new claims 39 or 42, or claims depending therefrom.

Applicant respectfully requests that the new claims 39, 42, and claims depending therefrom be entered and allowed.

New claims 36 and 37

New claims 36 and 37 include all of the limitations of claim 22, but also specify that a **blue flame detector** is used to detect the flame.

As explained in the specification:

> Yellow flame burners are often provided with a flame detector. Most detectors, which are used today, detect a particular wavelength associated with the yellow colour of the flame. **Applicants have now found that when a Fischer-Tropsch derived fuel is used the commonly known detectors fail to observe the resulting blue coloured flame. For this reason the yellow flame burner is preferably provided with a detector, which can detect this blue flame.** Examples of suitable detectors are the detectors that are used in blue flame burners. Alternatively additives may be added to the Fischer-Tropsch derived fuel which result in a flame which can be detected by the above standard yellow flame burner detector.

Specification, page 6, ll. 9-27 (emphasis added).

The examiner cannot point to a teaching or suggestion in any of the cited references that burning the claimed low density liquid Fischer-Tropsch products using a yellow flame burner would produce a **blue flame**. The examiner certainly cannot point to a teaching or suggestion to burn the claimed low density liquid Fischer-Tropsch products in a yellow flame burner, and to use a **blue flame**

detector to detect the resulting flame. Nor can the examiner establish an apparent reason to combine the references in the fashion claimed.

Applicant respectfully requests allowance of new claims 36 and 37 for this additional reason.

__The Objective Indicia of Non-Obviousness__

In response to Applicants' arguments, the examiner cited a new reference, GB 2,215,032 A to Shin. Both Shin and Chen are objective indicia of non-obviousness of the claims for the following reasons.

__-Shin__

The examiner states that "[w]hile acknowledging certain drawbacks of using high ignition point liquid fuels in portable space heaters, [Shin] nonetheless recognizes kerosene and diesel fuels as interchangeable and suitable equivalent fuels for use in space heaters," and that Shin "teaches that increased efficiency and lowered environmental pollutants result when applying suitable preheating and gasifying techniques to the combustion of kerosene and diesel fuels." Office Action, page 4.

Applicant has conceded that diesel fuel is used for domestic heating in some markets. However, Shin acknowledges that:

> It is found that most fuels for gasifying stoves are kerosene and Diesel fuel oil which are of high igniting point. Hence, in order to cause the fuel to be burned easily, it is commonly suggested to set a preheating procedure so that the fuel will be heated prior to its gasification thereby helping to combust [] the fuel. **However, the temperature increase[] in such preheating procedure is often insufficient to cause a complete combustion, thus wasting fuel, lowering the efficiency as well as polluting the environment.**

Shin, p. 1, ll. 4-17 (emphasis added).

Shin acknowledges the problem that fuels used in "gasifying stoves" are guilty of "polluting the environment." Nevertheless, Shin does not teach or suggest feeding a diesel fuel comprising a *Fischer-Tropsch* product to the burner to solve this problem.

<u>-Chen</u>

Chen acknowledges that "requirements for low sulfur middle distillates, especially diesel fuel and **home heating oil** is expected to lead to **more stringent specifications for those products.**" Chen, col. 1, ll. 33-36 (emphasis added). Chen clearly was aware that Fischer-Tropsch products existed. Chen states that suitable feeds for his process include "feeds from synthetic oil production processes such as Fischer-Tropsch synthesis" Chen, col. 6, ll. 17-22.

Nevertheless, **the examiner cannot point to any teaching or suggestion in Chen to use a Fischer Tropsch fuel as a component of a feed to a yellow flame burner *in order to produce home heating oils that meet more stringent requirements*.**

Of course, the examiner contends that he has pointed to just such a teaching or suggestion in Chen. The examiner contends that "Chen teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, a process for using or burning middle distillate Fischer-Tropsch derived fuel . . . as a 'home heating oil.'" Citing col. 10, ll. 16-34. Office action, p. 8. Such a reading of Chen grossly overstates what Chen teaches.

Chen describes an integrated refining process for producing a large variety of products. Home heating oil is only one of a vast array of products that can be made using Chen's process.

Chen mentions that a Fischer Tropsch feed is one of several possible alternative feeds to Chen's "integrated refining process" to make Chen's vast array of products. Chen's statement **is not a teaching or suggestion to use one or more liquid Fischer Tropsch product having the claimed low density as a feed or as a component of a feed to a yellow flame burner.**

-Shin and Chen are objective indicia that the <u>claimed solution to the problem was not obvious</u>

The fact that the examiner cannot point to a teaching or suggestion in Shin or Chen of the claimed solution to this recognized problem is evidence that others confronted with the problem have failed to find the claimed solution to the problem.

The examiner cannot point to any reference teaching or suggesting the claimed solution the problem over the course of the 20 long years following the issuance of Shin and Chen. This is evidence of a long felt but unmet need, and is strong evidence that the claims are not obvious. *Graham* v. *John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966). *DyStar Textilfarben GmbH v. C.H. Patrick Co.,* 80 U.S.P.Q.2d 1641, 1645 (Fed. Cir. 2006).

CONCLUSION

Applicant respectfully requests entry, consideration, and allowance of the new claims. If the examiner finds the application other than in condition for allowance, the examiner is requested to call the undersigned attorney at the Houston, Texas telephone number (713) 334-5151 x 200 to discuss the steps necessary for placing the application in condition for allowance. The Commissioner is hereby authorized to charge any fees in connection with this paper, or to credit any overpayment, to Deposit Account No. **19-1800 (File No. TS8577)**, maintained by Shell Oil Company.

Respectfully submitted,

Paula D. Morris
Registration No. 31,516
THE MORRIS LAW FIRM, P.C.
10777 Westheimer Rd. Suite 1100
Houston, Texas 77042-0787
Telephone: (713) 334-5151 x 200
Facsimile: (713) 334-5157
ATTORNEYS FOR APPLICANTS